

Role of the Intra-Atrial Electrogram in the Clinical Interpretation of Arrhythmias

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IRREGULARITIES OF THE cardiac rhythm are a common phenomenon in patients with heart disease. The prompt treatment of an arrhythmia is facilitated by the exact diagnosis of the abnormal rhythm. The key to arrhythmia diagnosis is the determination of the temporal relationship between atrial and ventricular activation.

During many tachycardias atrial activity (P waves) frequently can not be seen on the standard lead surface electrocardiogram; consequently, it may be difficult or impossible to determine the origin of a tachycardia, i.e. sinus, atrial, A-V nodal or ventricular. Recording of the right intra-atrial electrogram, clearly defines the atrial rhythm, and the temporal relationship of atrial to ventricular activation.

An electrode wire or a standard bipolar electrode catheter, with electrodes 1 cm apart, can readily be passed into the right atrium via a needle puncture of the femoral vein or surgically exposed antecubital vein. From an electrode wire a unipolar intra-atrial electrogram can be obtained, and from a bipolar catheter a unipolar and bipolar intra-atrial electrogram can be recorded.

The unipolar intra-atrial electrogram is recorded by connecting an intra-atrial electrode to the V lead of the electrocardiograph machine. The unipolar electrogram records the entire electrical sequence of P wave and QRS complex, and magnifies the size of the P wave. The bipolar intra-atrial electrogram is obtained by connecting one intra-atrial electrode to the right arm lead and the other intra-atrial electrode to the left arm lead of the electrocardiograph machine, and recording on Lead I. The bipolar electrogram primarily records

the time of arrival of the atrial impulse in the area of the electrodes, and accurately delineates the timing of the P wave in the cardiac cycle. In the bipolar electrogram, the ventricular component (QRS complex) is usually a minor component or not present on the tracing. When the QRS complex and P wave are simultaneous, the time of atrial activation is clearly depicted by the bipolar intra-atrial electrogram. In most instances, atrial activity can be clearly delineated by the unipolar electrogram. However, not infrequently, the P waves are buried in the QRS complex or T waves, and the unipolar intra-atrial electrogram does not permit a clear definition of the rhythm. In these cases, recording of the atrial rhythm by the use of the bipolar electrogram clarifies the rhythm.

In our experience, the recording of unipolar and bipolar intra-atrial electrograms has been an important aid in the diagnosis of arrhythmias. In cases of atrial flutter and tachycardia the ventricular rate is easily determined from the standard electrocardiogram, but frequently the atrial rate cannot be ascertained. The intra-atrial electrograms clearly show the atrial rate. Thus, the degree of block at the atrioventricular node can be determined. Knowledge of the degree of A-V junctional block is often helpful in deciding upon the mode of treatment of an arrhythmia.

We have had a number of cases in which repeated electrocardiograms have been interpreted as sinus tachycardia with first degree atrioventricular block. However, upon the recording of intra-atrial electrograms these rhythms were shown to be atrial tachycardia with 2:1 A-V block. In one of these cases, the electrocardiogram was interpreted as sinus tachycardia with first degree heart block and incomplete right bundle branch block. There was an R' in the QRS complex in leads V1 and V2. The unipolar electrogram did not clarify the rhythm, but the bipolar electrogram clearly showed atrial tachycardia with 2:1 A-V block and the R' in leads V1 and V2 was not due to an intra-ventricular conduction defect but a P wave superimposed on the end of the QRS complex.

The recordings of intra-atrial electrograms have clarified the rhythm in five cases of tachycardias with irregularly irregular ventricular rates, which did not slow after the administration of relatively large doses of digitalis. Three of the above five arrhythmias had been interpreted as atrial fibrillation with a rapid ventricular response from standard lead electrocardiograms. In one case, atrial

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fibrillation with a rapid ventricular response was present; in two cases, atrial tachycardia with variable A-V block was present; and in two cases, a wandering atrial pacemaker with an irregular atrial rate and varying A-V conduction was present. The clarification of these arrhythmias facilitated their treatment.

In two cases of tachycardia, the ECG showed a regular rate and aberrant ventricular activation. On auscultation the first heart sound was of constant intensity. From these findings it could not be clearly established whether these were supra-ventricular or ventricular tachycardias. The intra-atrial electrograms revealed that one case was a ventricular tachycardia with atrial fibrillation and the other case was ventricular tachycardia with atrial standstill. The diagnosis of the arrhythmias facilitated their prompt treatment. These cases also demonstrated that the constant intensity of the first heart sound does not rule out ventricular tachycardia.

In A-V nodal rhythms and in certain instances of A-V dissociation, atrial activity may be obscured by the QRS complex. The recording of intra-atrial electrograms will clarify these rhythms. In A-V junctional rhythms there may be A-V dissociation, retrograde activation of the atria, or retrograde A-V block. In A-V dissociation there is a beat-to-beat change in the temporal relationship between atrial and ventricular activation, because the atria and ventricles are beating independently of each other. When retrograde atrial activation is present there is usually a fixed temporal relationship between ventricular and atrial depolarization. In cases of A-V junctional rhythms with retrograde A-V block the atria are either beating slower than the ventricles or atrial standstill may be present. The specialized conduction system of the heart is a two-way conducting system. Therefore, in the presence of A-V dissociation, when the atria are beating at a significantly greater rate than the ventricles, antegrade A-V block is present. When the atria and ventricles are beating independently of each other at about the same rates (isorhythmic A-V dissociation), a functional rather than a pathologic block is usually present at the A-V node. When the ventricles are beating at a faster rate than the atria retrograde A-V block is present.

In complex arrhythmias, the recording of unipolar and bipolar intra-atrial electrograms always depicts the temporal relationship between atrial

and ventricular activation. The delineation of the time relationship of atrial to ventricular depolarization is an important aid in arrhythmia diagnosis and treatment.

The Second National Congress On Medical Ethics

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ESCALATING RATE OF change in practices of Medicine, and the interest and active participation in Medicine on the part of interested citizens not necessarily possessing professional training, were primary themes recurring throughout the American Medical Association's Second National Congress on Medical Ethics held October 5 and 6 in Chicago. Only three years passed between the first national congress and the need to hold the second one. The AMA estimates that a Third National Congress on Medical Ethics may be needed as early as 1970.

Our current ethical dilemmas stem from innovations such as: cracking the genetic code so that man now possesses the power to tamper with heredity. But who will decide in which direction an individual's heredity is to be changed? Or how extensively should artificial insemination be utilized? In connection with organ transplant, what criteria of death are most reliable? And what about euthanasia, still recommended by some persons? By what criteria may it be determined when an organ for transplant may ethically be taken from a donor? And who decides what recipient is to live (with a donor organ) and which person is to be left to die? Medical innovations such as organ transplants or kidney dialysis are very costly. Who is to decide whether the available capital is better spent for transplants, dialysis, or food for the starving? These questions were dealt with at the second national congress.

"Medical Ethics always has been primarily for the benefit of the people and secondarily for the benefit of Medicine," said Chauncey D. Leake, Ph.D., Sc.D., of the University of California, San